Extension-Based Exercises in Conjunction with Manual Therapy and Strengthening for Acute Low Back Pain with Associated Lumbar Radiculopathy: A Case Report

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EXTENSION-BASED EXERCISES IN CONJUNCTION WITH MANUAL THERAPY AND STRENGTHENING FOR ACUTE LOW BACK PAIN WITH ASSOCIATED LUMBAR RADICULOPATHY—A CASE REPORT

by

Marcé Schultz

A Scholarly Project Submitted to the Graduate Faculty of the

Department of Physical Therapy
School of Medicine
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in partial fulfillment of the requirements for the degree of

Doctor of Physical Therapy

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This Scholarly Project, submitted byMarcé Schultz in partial fulfillment of the requirements for the Degree of Doctor of Physical Therapy from the University of North Dakota, has been read by the Advisor and Chairperson of Physical Therapy under whom the work has been done and is hereby approved.

(Graduate School Advisor)

(Chairperson, Physical Therapy)
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Title Extension-Based Exercises in Combination with Manual Therapy and Strengthening for Acute Low Back Pain and Associated Radiculopathy: A Case Report

Department Physical Therapy

Degree Doctor of Physical Therapy

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Date 08/23/16
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ABSTRACT

Background and Purpose: The purpose of this case report is to describe a case in which extension-based exercises derived from the method of mechanical diagnosis and treatment (MDT) in correlation with manual therapy and strengthening were applied to a patient with acute low back pain and lumbar radiculopathy.

Case Description: I present the case of a female patient who worked as a certified nursing assistant and injured her back while attempting to transfer a patient. Workmen’s compensation was filed and the patient was referred to physical therapy. Through an extensive historical intake and examination procedure, we determined that the patient signs and symptoms were consistent with lower lumbar disc derangement and radiculopathy.

Intervention: A physical therapy plan of care with a primary focus on extension-based exercises were implemented along with manual therapy lumbar mobilization techniques and strengthening exercises.

Outcomes: Within 9 treatment sessions the patient’s pain decreased and her symptoms localized. She was able to return to work without restrictions.

Discussion: This case highlights a course of treatment consisting primarily of extension-based exercises derived from the method of MDT for acute low back pain and lumbar radiculopathy. Low back pain continues to be prevalent in society.
CHAPTER I

BACKGROUND AND PURPOSE

Back pain is extremely prevalent. The US National Library of Medicine reports that during some point in life, 8 out of 10 people experience it. Back pain rarely indicates a serious illness or disease but it greatly affects participation and quality of life. An appropriate examination procedure is important, however, in order to rule out any rare pathologic associations and to develop a sound treatment plan.

Acute back pain commonly lasts up to a few weeks and develops suddenly while any pain that lasts longer than three months is referred to as chronic. A common cause of acute low back pain is lumbar disc herniation. Disc herniation is prevalent in overweight middle age males and is likely to occur due to repetitive activities such as twisting or pulling and improper lifting techniques. Smoking and a sedentary lifestyle are other risk factors associated with disc herniation. Discs are located between vertebrae of the spinal column. Cushion- and jelly-like in nature, the purpose of a disc is to provide shock absorbance from pressure on the spine. Because of its jelly-like properties, repetitive motion and/or sudden strain on the spine can cause a disc to herniate. A herniation may place pressure on nerve roots exiting the spinal column and lead to radiculopathy consisting of tingling, numbness and/or weakness along the nerve pathway.

Conservative intervention is often a successful treatment option for disc herniation and radiculopathy. Shin et al conducted a long term observational study of 92
individuals treated conservatively for disc herniation. Following an intervention program, pain, healthcare status, and functional ability were recorded yearly for 5 years. Statistical results showed conservative treatment had favorable long-term outcomes for individuals with disc herniation. In addition, Reiman et al conducted a systematic search of articles related to surgical and non-surgical treatment of lumbar disc herniation in athletes and return to sport. Results of 14 studies found no significant difference between surgical and conservative treatment and athletes return to sport.6

The McKenzie method, or exercises derived from the principle, is commonly used to conservatively treat spinal disc involvement. The McKenzie method is an assessment, diagnosis, and treatment tool that uses an exercise-based approach.7 The McKenzie method has come to be known as Mechanical Diagnosis and Treatment (MDT). During a MDT assessment, a therapist monitors a patient’s response to directional positions. A diagnosis and treatment is developed based on the response. Paatelma et al8 compared the effectiveness of multiple physiotherapy methods in the treatment of low back pain. The study consisted of 134 acute to chronic low back pain subjects randomly assigned to one of 3 groups: specialized orthopedic manual therapy, McKenzie method, and advice on staying active. Data on leg, back pain, and disability were collected at initial visit, then at 3, 6, and 12 months later. At 6 and 12 months there was a significant improvement in back pain and disability in the McKenzie group compared to advice group and also manual therapy compared to advice group. There were no significant differences between orthopedic manual therapy and McKenzie groups at any time during the study.
The purpose of this case study is to describe outcomes of extension-based exercises derived from the method of MDT in correlation with manual therapy and core stability in a patient with acute low back pain and minor lumbar radiculopathy.
CHAPTER II

CASE DESCRIPTION

The patient, employed as a certified nursing assistant, acquired the injury at her place of work. She was repositioning a hospital patient who was in bed and lying on his side. As she rolled the patient towards her, in an attempt to place him on his back, he jerked forward and pulled her with him. During the incident she felt a sharp pain in her low back. The pain persisted which led her to seek medical attention 4 days later. She processed her care through workers compensation and her medical provider advised her to modify her work duties and referred her to physical therapy to evaluate and treat right sided low back pain. The patient reported that following physical therapy she would like to be pain free so she could participate in life without discomfort and return to her regular work duties.

History

The initial session was approximately 60 minutes long and consisted of a thorough historical intake and appropriate tests and measures. The discussed patient was a 45-year-old Caucasian female who was 5’10” tall and 235 pounds. As previously mentioned, the patient was employed at a local hospital as a certified nursing assistant. The majority of her work activities were physical in nature where she would bend, squat and lift while she assisted patients. Outside of work, her time was occupied by caring for
her three children; a set of twin girls and a son. Her son was diagnosed with autism at a young age but functioned well with some slight cognitive impairments. The patient was recently divorced and she had primary custody of her children. She lived in a three-bedroom apartment on the second floor.

Medical and surgical records were obtained through hospital charts and records. Anxiety and depression was included in her history but throughout physical therapy treatment she presented with no signs of psychological impairment. In addition, the patient had a history of arthritis and Hashimoto’s thyroiditis. These were taken into account during treatment sessions. Also taken into account was the patient’s self-reported surgical history of a laminectomy 3 years prior.

Following her injury, the patient was prescribed medications for pain and muscle spasms. A 50-mg tablet of Tramadol (Ultram) was to be taken every 6 hours or as needed for pain along with 5 mg of cyclobenzaprine (Flexeril) 3 times a day for muscle spasms. The patient reported that the pain was primarily located across her entire back with the right side worse than the left. She also had some additional pain in her right ankle which had been present since the incident. A tingling and numbing sensation was felt in her right foot the day after the injury but it had subsided. There was no observational evidence and she reported no specific incident of an ankle injury. Her back pain was lessened while standing compared to sitting and she reported difficulty in driving and walking up the stairs. The pain affected self-cares and homemaking and work duties were modified. Prior to injury the patient was pain free without any restrictions. She had no
back pain or discomfort since her laminectomy. Before physical therapy, the patient had no prior treatment for this injury besides the doctor-prescribed medications. Overall, she gained some pain relief through ice, pain medications, and standing in an upright position. On a 1 to 10 rating scale, the patient rated her pain level as 5/10 with movement and 3/10 at rest. We were able to clearly observe that the patient was in extreme discomfort. She stood up throughout the initial session and leaned against the wall cautious about moving into alternate positions. Her postural analysis indicated slightly rounded shoulders, forward head and decreased lumbar lordosis. She ambulated independently but with reduced cadence and increased hip rotation.

**Examination, Evaluation, and Diagnosis**

To evaluate, diagnose, and monitor progress, tests and measures were taken at the initial session, throughout the patient’s therapy, and at discharge. The tests and measures included active range of motion, directional preference, manual muscle test, myotomes, dermatomes, joint play, and special tests.

**Active Range of Motion (AROM) and Directional Preference (DP)**

Trunk AROM was assessed in standing at the initial, 2 weeks, and discharge sessions. At the initial session limitations due to pain were recorded in all motions (Table 1). The concept of defining a directional preference (DP) is derived from the McKenzie method of MDT. In order to appropriately determine a DP, the patient is asked to demonstrate repeated AROM to end range in multiple directions. Centralization, which refers to the act of pain moving from a distal to proximal region, is examined during repeated motions. Clinical outcomes have shown consistently better results in patients
whose pain centralizes rather than peripheralizes. Following a set of repetitions, ROM is reassessed and a report on intensity and location of pain is given. The DP that centralizes symptoms is commonly used for diagnostic and treatment procedures. Razmjou et al. found that determining a DP during a low back assessment results in high interrater reliability. In the study, 2 highly trained physical therapists assessed 45 individuals using principals derived from the MDT method to determine centralization and DP. The agreement between the therapists with regards to the subjects DP was 97% (k=0.96).

Our patient performed repeated flexion in standing (RFIS) 10 times. Following the test she reported an increase of pain in both her back and foot and demonstrated no increase in ROM. Repeated extension in standing (REIS) was also performed 10 times. Following this test the patient reported increased pain in her back but no change in foot pain (Table 1).

**Manual Muscle Test (MMT)**

Lower extremity strength was assessed through MMT at initial, 2 weeks, and discharge sessions. All strength testing was administered as shown in “Cram Session in Goniometry and Manual Muscle Testing: A Handbook for Students and Clinicians”. Hip flexion, internal rotation, external rotation, and abduction were all weaker on right compared to the left (Table 1). Knee extension and flexion were strong (5/5) on bilateral extremities but painful on the right compared to the left.
Myotomes

Myotomes are a group of muscles innervated by a single nerve root and tested by determinants of strength to rule in nerve involvement related to injury.\textsuperscript{12} We tested myotomes at initial and discharge sessions. Hip flexion (L1-2), knee extension (L3), ankle plantarflexion (S1), and knee flexion (S2) tested negative. Ankle dorsiflexion (L4) and great toe extension (L5) tested positive for nerve involvement as both were weak with no pain on right and strong and painless on left (Table 1).

Dermatomes

A dermatome is an area of skin innervated by a single nerve root.\textsuperscript{12} It is an additional test to determine if there is nerve involvement related to an injury or disease. Light touch is applied to an area of skin in correspondence to the dermatomal pattern. The examinee is instructed to lie supine and close the eyes to avoid seeing where and when the examiner is touching. The examinee is then instructed to report if the sensation feels the same or different on both extremities. Findings are recorded as negative, equal sensation in bilateral extremities, or positive, unequal sensation in bilateral extremities. Our patient tested positive in dermatomal regions of L3, L4, and S1. (Table 1).

Special Tests

To assist with the evaluation and diagnosis process, special tests were carried out to rule in or rule out muscle, nerve, and/or pathological involvement. The slump test indicates involvement of nerve root tension identified by reproduction of symptoms and decreased ROM brought on during the test.\textsuperscript{12} Our patient presented with a positive slump
test as she reported increased pain when put in a slouched position. The symptoms intensified when slight overpressure was applied to her back and her knee passively extended.

Straight leg raise (SLR) is an additional test to determine neurological involvement.\textsuperscript{13} Capra et al\textsuperscript{13} used magnetic resonance imaging (MRI) findings as a reference to assess validity of the SLR test in a group of subjects with L4-5 and L5-S1 lumbar disc herniation. With a sensitivity rate of 0.36 and a specificity rate of 0.74, results showed that SLR test alone is not an adequate tool to diagnosis lumbar disk herniation. Of 2352 subjects who partook in the study, MRI findings indicated 1305 had lumbar disc herniation while only 741 subjects presented with a positive SLR. Although this study concluded low accuracy, the SLR test is highly subjective and based upon symptomatic evidence. It is possible for a patient to present with no symptoms but show lumbar disc herniation on an MRI. In addition, the study reported using SLR test alone as a diagnostic tool and did not combine it with any other tests. This may have affected results.

Despite low accuracy ratings, a SLR test was performed on our patient. Due to a reproduction of symptoms during the test, we suggested neurological tissue involvement. The referring doctor did not order an MRI so a reference standard was not available.

Hip pathologies may accompany or correspond with back pain. These pathologies may include but are not limited to capsular adhesions, loss of joint congruity, osteoarthritis, labral tears, avascular necrosis, and impingement.\textsuperscript{12} Special tests commonly
used to rule in hip pathological involvement include FABER test and scouring test. Pain or apprehension during the application of either test would indicate positivity. Our patient was negative for both tests.

True leg length discrepancy is a measurement taken from the patient's anterior superior iliac spine (ASIS) to medial malleolus on bilateral extremities. Unequal leg length may be associated with pain or discomfort along the anatomical chain including knee, hip or back. Our patient had a right leg length of 96cm and left leg 97cm. A difference of 1-1.5cm is considered within functional limits.

**Joint Play**

Posterior anterior accessory testing of the vertebral joints was evaluated by applying graded pressure along the patient's lumbar and thoracic spine. Joint restriction was palpable and tenderness was felt along the lumbar spine at approximately vertebral regions L3-5.

**Functional Assessment**

The Quebec Back Pain Disability Scale is a self-administrated questionnaire consisting of 20 questions related to physical everyday activities that may be affected due to back pain. The assessment is designed to determine the perceived level of functional disability. Each question is scored between 0 and 5 (0 = no difficulty completing task and 5 = unable to do task). A score of 100 would indicate 100% disability. Rocchi et al compared 9 different functional scales for low back pain. Data was obtained through scientific literature that evaluated psychometric, technical and practical properties.
of the 9 questionnaires, 3 proved to be fully validated: Quebec Back Pain Disability Scale, Oswestry, and Roland-Morris Disability Questionnaire. The Quebec scale demonstrated good test retest reliability (ICC=0.92) and good concurrent validity in correlation with Morris Disability Questionnaire (r=0.80). Completed at her initial and discharge session, the patient filled out the Quebec Back Pain Disability Scale to determine functional ability. She initially scored 30/80 (38% disability) as she left a few questions blank.

**Evaluation and Diagnosis**

As we reviewed the examination in its entirety, we were able distinguish signs, symptoms, tests and measures consistent with lumbar disc involvement likely on the right side. The patient’s age, stature, occupational duties, and mechanism of injury proved to be compatible with disc herniation risk factors. She presented with a DP for extension through centralization of symptoms. Myotome and dermatomal testing suggested right side nerve tissue involvement, which was supported by a positive slump and SLR test. Hip pathologies were ruled out due to negative outcomes of additional special tests. The patient presented with minor but noticeable functional disability as she received a score of 30/80 (38% disability) on Quebec Back Pain Disability Scale. She was able to work and perform daily activities but she had to develop modifications due to pain and discomfort. Overall the patient’s predominant concerns were pain, range of motion and functional disability. Because of the acuteness of her injury and the association with musculoskeletal and neurological involvement, she was an excellent candidate for
physical therapy treatment. A physical therapy diagnosis that was consistent with impaired joint mobility, motor function, and muscle performance, range of motion, reflex integrity and spinal derangement associated with MDT was given to the patient.

**Prognosis and Plan of Care**

The patient's rehab potential was good due to her motivation, health status, and prior level of function. She also exhibited no functional limitations and was alert, oriented, and followed commands appropriately.

Short and long term goals for the patient were set following the initial examination. Short term goals were designed to be completed in 2 weeks while long term goals were to be completed by discharge. Discharge was estimated to be approximately 5 to 6 weeks following initial evaluation. The goals addressed pain, ROM, strength, disability, and home exercise adherence and were designed to demonstrate progression to prior level of function and specific functional tasks that included transferring patients at work and sitting in a car or chair for an extended period of time. All the goals had a measurable component. Due to the acuteness of the injury we wanted to address the problem immediately and aggressively. The patient was scheduled for therapy 3 times a week for 30 minutes sessions with hopes to achieve optimal outcomes.
Short Term Goals

1. Patient will report pain level at 3/10 following shift at work in order to progress to baseline.

2. Patient lumbar AROM will increase to any degree with minimal pain in order sit in car for extended period of time with marginal discomfort.

3. Patient will score 18/80 (22% impaired) or less on Quebec Back Pain Disability Scale in order to progress to prior level of function.

4. Patient will demonstrate independence with HEP in order to manage symptoms at home.

Long Term Goals

1. Patient will report average pain level at 1 to 2/10 following work shift in order to return to full work shift and normal work duties with minimal to no discomfort.

2. Patient lumbar AROM will measure within functional limits (WFL) with no pain in order to transfer patients at work with no discomfort.

3. Patient will score 8/80 (10% impaired) or less on Quebec Back Pain Disability Scale in order to return to prior level of function.

4. Patient bilateral lower extremity strength will be 4+/5 without pain in order to prevent future injury.

5. Patient will demonstrate independence with progressed HEP.
<table>
<thead>
<tr>
<th>Tests</th>
<th>Initial</th>
<th>2 Weeks</th>
<th>Discharge</th>
</tr>
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<tr>
<td>AROM</td>
<td>Trunk</td>
<td>Trunk</td>
<td>Trunk</td>
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<tr>
<td>Flexion</td>
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<td>WFL/no pain</td>
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<td>&gt; pain in back and foot</td>
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<td>NA</td>
</tr>
<tr>
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<td>minimally limited/no pain</td>
<td>minimally limited/no pain</td>
</tr>
<tr>
<td>REIS</td>
<td>&gt; pain in back</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>R Sideband</td>
<td>moderately limited</td>
<td>WFL/slight pain</td>
<td>WFL/no pain</td>
</tr>
<tr>
<td>L Sideband</td>
<td>moderately limited</td>
<td>WFL/slight pain</td>
<td>WFL/no pain</td>
</tr>
<tr>
<td>MMT</td>
<td>Right</td>
<td>Left</td>
<td>Right</td>
</tr>
<tr>
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<td>5/5-NP</td>
<td>5/5-NP</td>
<td>NA</td>
</tr>
<tr>
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<td>3/5-P</td>
<td>4/5-NP</td>
<td>4/5-NP</td>
</tr>
<tr>
<td>Hip Internal Rotation</td>
<td>4/5-P</td>
<td>4+/5-NP</td>
<td>4+/5-NP</td>
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<tr>
<td>Hip External Rotation</td>
<td>4/5-P</td>
<td>4+/5-NP</td>
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<tr>
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<td>5/5-P</td>
<td>5/5-NP</td>
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<tr>
<td>L4 (Ankle DF)</td>
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</tr>
<tr>
<td>L5 (Great Toe Ext)</td>
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</tr>
<tr>
<td>S1 (Ankle PF)</td>
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<tr>
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<tr>
<td>L2 (Medial Thigh)</td>
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<td>L4 (Medial Ankle)</td>
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<td>L5 (Dorsum of Foot)</td>
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<tr>
<td>S1 (Lat Side of Foot)</td>
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<td>Score</td>
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<td>4/100 (4% disability)</td>
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</tbody>
</table>

Abbreviations: AROM, Active Range of Motion; RFIS, Repeated Flexion in Standing; REIS, Repeated Extension in Standing; MMT, Manual Muscle Test; DR, Dorsiflexion; PF, Plantarflexion; VMO, Vastus Medialis Oblique; ASIS, Anterior Superior Iliac Spine; Spine; NA, not addressed; NM, observed but not measured; WFL, within functional limits; NP, no pain; P, pain
CHAPTER III

INTERVENTION

Interventions provided throughout therapy were designed to decrease pain and inflammation, increase lumbar ROM, and improve core and lower extremity strength to ultimately improve quality of life and prevent future injury. Lumbar extension exercises, spinal mobilizations, modalities, and patient education were initiated early on to address pain and ROM. As pain began to subside and ROM increased we focused on core and lower extremity strengthening to address any weakness that might result in re-injury. In addition to physical therapy, the patient was treated by other healthcare professionals as well. Because the initial incident happened at her place of employment, she filed workers compensation and was required to follow up with a workers compensation doctor and occupational therapy.

Lumbar Extension Exercises

Exercises initiated early on were primarily extension based as an extension preference was determined at initial exam. My clinical instructor and I were not McKenzie certified in MDT, however, the extension-based interventions utilized were derived from the MDT method. Treatment was initiated immediately following the initial exam. At this time the patient was asked to perform prone-on-elbow exercises. She was instructed to lie on her stomach while propped on her elbows for up to 3 minutes.
This exercise was difficult as the patient’s symptoms increased immensely in her low back. Because she reported no increased pain in her foot or leg and her symptoms appeared to be centralizing, we encouraged the patient to push through as much as she could tolerate. After the initial session, the patient was given a home exercise program (HEP) handout with instructions to perform prone-on-elbow exercises daily every 1 to 2 hours for up to 5 minutes. Symptoms decreased during prone-on-elbow exercises as the patient demonstrated adherence to her HEP. At this time, however, she was still having pain during regular activity so we progressed the program by adding prone press ups. Prone press ups were actively and independently performed by the patient while lying in a prone position on the table. She was instructed to use both hands to push her upper body off the table while extending her back through its full range of motion. As the patient continued to demonstrate progression, in order to promote greater ROM, she was instructed to perform a prone press up while taking a deep breath out, sagging her stomach towards the table. Physical therapist overpressure, accomplished by the therapist providing manual pressure at the site of injury, was also provided during prone press ups to encourage greater ROM. Finally, as the patient tolerated more functional activities, she was instructed to perform repeated extension in standing (REIS) and encouraged to do this during her work shift. Throughout treatment the patient’s HEP was modified as new extension based exercises were added and she progressed.
**Spinal Mobilization**

Spinal mobilizations are provided manually by a therapist to increase spinal motion and reduce pain. Our patient received lumbar region posterior to anterior (PA) mobilizations and unilateral glides that were initiated early and performed in addition to lumbar extension exercises.

Shah and Kage conducted a research study comparing the effectiveness of PA mobilization versus prone press ups in 40 patients with low back pain. The study found that both interventions provided significant improvement in pain reduction, lumbar ROM, and functional outcome.

We initially applied grade I to II mobilizations to address pain and discomfort and progressed to grade III to IV to promote physiological change. Mobilizations were usually done between lumbar extension exercises for an equal amount of time along the lumbar region (L1-5).

**Modalities**

Following therapy sessions and to address elevated pain, electrical stimulation and a cooling pack was applied to the lumbar region. With the patient positioned on her stomach, electrical pads were placed on both sides of her back for 15 minutes. A cold pack was applied over the pads. Manual and mechanical traction was also provided for pain relief and to distract and take forces off the spine. During manual traction, the patient was instructed to lie with hips and knees at 90 degrees supported by a large exercise ball. One end of a belt was looped around the patient's thighs while the other
end wrapped around the therapist hips. Manual distraction of the low back region was felt as the therapist hips rocked back. Mechanical traction was delivered on a traction table with the patient in prone for 10 minutes with a static pull of 50 pounds as this was most comfortable for the patient. The patient was provided with an emergency stop button and educated on when to use it. Mechanical traction has been shown to reduce the size of disc herniation when forces of 60-120lb are provided\textsuperscript{17}. Traction is also more effective on disc herniation when applied shortly after injury and with patient in prone\textsuperscript{17}.

**Core and lower extremity strengthening**

Core and lower extremity strengthening was initiated as pain was decreased and ROM was restored. These exercises were introduced by demonstration and through verbalization. Core stability exercises included supine pelvic tilts (10x with 5 second hold), double and single leg bridges (10x with 5 second hold), prone planks on elbow and knee (15 second progressing to 60 second), and quadruped bird dog (10x bilaterally 5 second hold). Exercises to strengthen the lower extremity focused mainly on hip flexors and abductors and included straight leg raises (SLR), side lying hip abduction, and clam shells. The patient was provided with a HEP handout for each exercise. Repetitions, duration, and resistance through the addition of weights and Thera bands increased as the patient progressed.

**Education and postural training**

Education on proper posture and body mechanics was a crucial part of this patient’s treatment program and it was provided at each session. Statistics show that the
The majority of work site injuries among nursing aides occur due to overexertion and bodily reactions stemming from poor lifting, reaching, and bending habits. Initial education about the patient diagnosis was provided using models and diagrams of the spine. Further education on sitting posture and lifting mechanics were incorporated in therapy sessions to help prevent recurrence of injury.

Other

During the patient’s 6th and 7th visit she complained of an insidious onset of left hip pain. Unaware if the pain was due to her back injury or elsewhere we addressed the issue and incorporated PA hip glides and distraction of the left lower extremity in her intervention session. We also added piriformis stretch to her HEP. Piriformis syndrome is caused by an abnormal condition of the piriformis muscle which is normally located slightly superior to the sciatic nerve. In about 22% of the population the sciatic nerve either splits or pierces the piriformis predisposing these individuals to piriformis syndrome. Signs and symptoms of piriformis syndrome are often mistaken as lumbar radiculopathy. As many as 6% of individuals diagnosed with back pain have piriformis syndrome. Because signs and symptoms of piriformis syndrome can masquerade as low back pain and radiculopathy, we made sure to be complete and incorporate a piriformis stretch into the patient HEP to address any increased tightness or muscles abnormalities that may be affecting the sciatic nerve.
<table>
<thead>
<tr>
<th>Session</th>
<th>Lumbar Ext. Exercise</th>
<th>Mobilizations</th>
<th>Modalities</th>
<th>Core Strength</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>POE</td>
<td>NA</td>
<td>IFC, Cold</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>POE, PPU</td>
<td>PA</td>
<td>man traction, IFC, Cold</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>POE, PPU, PPU/sag</td>
<td>PA, UG</td>
<td>man traction, IFC, Cold</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>PPU, PPU/sag, PPU/PT</td>
<td>PA, UG</td>
<td>IFC, Cold</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>PPU</td>
<td>PA, UG</td>
<td>mech traction</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>PPU/sag, PPU/PT</td>
<td>back/hip PA, UG</td>
<td>mech traction</td>
<td>P Tilt, D LB, S LB, S L R</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>PPU, PPU/PT</td>
<td>PA, UG, L LE distract.</td>
<td>NA</td>
<td>P Tilt, D LB, S LB</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>PPU, REIS</td>
<td>PA, UG</td>
<td>man traction, IFC, Cold</td>
<td>S LR, clam shell, hip abd</td>
<td>Pir. Stretch</td>
</tr>
<tr>
<td>9</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>P Tilt, D LB, S LB, plank</td>
<td>Pir. Stretch</td>
</tr>
</tbody>
</table>

Abbreviations: POE, prone on elbows; PPU, prone press up; PPU/sag, prone press up with sag; PPU/PT, prone press up with PT overpressure; REIS, repeated extension in standing; IFC, electrical stimulation; PA, posterior to anterior glide; UG, unilateral glide; P Tilt, pelvic tilt; D LB, double leg bridge; S LB, single leg bridge; S LR, straight leg raise; Pir, piriformis; man, manual; mech, mechanical; NA, non addressed.
CHAPTER IV

OUTCOMES

The patient was seen by skilled physical therapy for 9 visits within a 5-week time span. She noticed improvement within the first week following her initial evaluation and after the initiation of a few extension-based exercises. By her 2nd visit, she reported that her ankle pain had completely disappeared with discomfort primarily located in her low back. At her 6th visit the patient experienced increased unidentifiable pain in her left hip and at her 7th visit increased pain, numbness, and tingling of her right foot. Interventions were adjusted to accommodate for the flare up. At discharge, however, she rated her pain at 0/10 at rest and 1/10 at work on a 0 to 10 pain scale. A week prior to discharge, the patient had been cleared by her doctor to perform all her usual work duties. When addressed, she reported no increased pain since her doctor’s clearance. Reassessment indicated that lumbar ROM was pain free and full with the exception of extension, which was minimally limited. In addition, no pain was reported and some improvement was noted in lower extremity strength. Hip flexion strength improved to 4/5 bilaterally and abduction improved to 4+/5 on the right and 4/5 on the left. Hip internal and external rotation also improved as both were graded at 4+/5 bilaterally. At discharge, the patient scored 4/100 on the Quebec Back Pain Disability Scale. This score indicated 4% functional disability or 96% ability (Table 1).
Throughout the duration of therapy, the patient remained adherent to her HEP. She did, however, miss 2 sessions and was unseen for 10 days. This may have accounted for her flare up. At her 9th visit, the patient felt satisfied with her progress and outcomes and chose to discharge from physical therapy.
CHAPTER V

DISCUSSION

This case described the outcome of a physical therapy intervention program with a primary focus on extension-based exercises along with manual therapy in the treatment of a patient with acute low back pain and minor radiculopathy due to a work injury. Following 9 sessions of physical therapy the patient's pain and symptoms diminished while ROM increased and lower extremity strength improved. Additional studies researching similar intervention options have shown comparable outcomes. Peterson et al\textsuperscript{20} found promising results in the treatment of low back pain and nerve root involvement with either MDT method or spinal manipulations. Three hundred and fifty subjects suffering from low back pain with or without radiating symptoms for 6 weeks or more were randomly placed in a MDT group or spinal manipulation group. The outcome was the proportion of patients who reported success at a 2-month follow up. A reduction of 5 points or more in the 23-question Roland Morris Disability Questionnaire indicated success. Success was reported in both groups but not statistically significant in either.

Because strengthening exercises were initiated late in the treatment plan, it could be hypothesized that an improvement was due to a reduction of pain. Following her 9\textsuperscript{th} visit, the patient was able to return to her usual work activities and was independent in her HEP. At this time she chose to discharge from therapy. In addition, core strength was
never fully measured so progress or improvement in this area was not recorded. A few additional sessions incorporating functional strengthening exercises for both core and lower extremity would have been ideal to maintain gains and ultimately prevent future injuries. One study found that lumbar stabilization exercises showed better long term effects than general exercises in patients with lumbar disc herniation.21 A group of 63 young male adult subjects diagnosed with lumbar disc herniation were divided into a general exercise group or lumbar spinal stabilization group. Improvement in visual analog scale and functional scores were recorded in both groups at 3 and 12 months following treatment. Scores, however, were significantly better in the lumbar spinal stabilization group than general exercise group at 12 months post intervention.

Through an intervention program that consisted mainly of extension-based exercises and mobilizations with some core and lower extremity strengthening, the patient presented in this case had reduced pain and symptoms and improved ROM and function. There are some limitations, however, that may have affected the outcome. Extension-based exercises that were instructed to the patient were derived from the method of MDT but were taught by a therapist who was not officially certified in MDT. The delivery and process of exercises may have been altered or adjusted had the therapist been MDT certified. Additionally, the patient was only seen for 5 weeks (9 visits). She did show improvement at this time but there were no follow up appointments to determine if she had lasting results. Further research should include the difference in outcome when extension-based exercises are provided by a certified MDT specialist or a physical therapist without extensive training but using similar mechanisms. Other
research should also include follow up visits following 6 and 12 months of therapy to
determine long term outcomes.

**Reflective Practice**

Future cases with a similar presentation may proceed differently with regards to
examination, evaluation, and interventions based on the outcomes and research in this
study. I feel all pertinent and significant history questions were addressed. However,
during the examination, in order to accurately understand specific movements or
activities that the patient performed throughout her work day, we may have included
assessment techniques derived from the movement system balance concept. The
movement system balance approach, developed by Shirley A Sahrmann, is a diagnostic
and treatment approach through observational movement based on kinesiologic principles
and muscle length and strength testing. By asking the patient to physically perform a
functional movement during examination we might determine where she may be weak,
misaligned, or recruiting muscles improperly. These findings would help guide our
treatment plan and address habits that may prevent future problems.

The plan of care addressed pain, ROM, strength, and education. I feel these
aspects were all significant and corresponded with the examination findings. The
interventions we provided, however, heavily addressed pain, ROM, and education.
Strength training, including core and lower extremity, was not introduced until session 6.
By this time the patient was feeling well with minimal pain. She only received a few
treatments sessions that incorporated strengthening exercises until she chose to discharge.
An early strengthening program introducing some foundational exercises may have helped ensure lasting results. Strong stabilization of the injured area may prevent future problems.

Fortunately, in this patient’s case, improvements were noted very early using our therapy plan. If we had seen the patient for an extended period of time and determined no progress or pain reduction, we may have suggested the patient get imaging to determine other possible issues.

As addressed earlier, this patient was referred to physical therapy by a workers compensation doctor as she filed workforce safety following an injury as a certified nursing assistant. Because she filed workers compensation, she did not pay for her treatment. Had the patient paid out of pocket for her therapy services, her total cost would include evaluation, therapeutic exercise, manual therapy, and modality cost. According to the centers for Medicare and Medicaid services, the approximate cost of this patients therapy with regard to what Medicare pays out per service would be $923.48. Overall, I feel that the patient cost was reasonable considering the outcomes. Within 9 treatment sessions, her pain reduced significantly and her functionality returned to its prior level as she passed her workers disability test and was able to do all regular occupational activities without restrictions. I feel it is not feasible to reduce the cost of this patient’s treatment and retain the same outcomes as she was seen for a rather short period with a good response.
This case was influential on my developmental and professional goals. Because I was able to see the positive outcomes of a treatment plan highly centered on an examination and intervention plan derived from MDT, I feel further education of the method would be beneficial. Becoming certified MDT specialist would optimize my examination and treatment procedures to offer greater options for patients.

**Conclusion**

In summary, this case report follows the rehabilitation process of a patient with low back pain and radicular symptoms. Through an extensive historical intake and examination process a physical therapy diagnosis of disc derangement was determined. A therapy plan of care with a primary focus on extension-based exercises were administered and the patient experienced a reduction in pain and a localization of her symptoms. This case highlights an intervention procedure that consisted of exercises derived from the method of MDT in correspondence with spinal mobilizations and lower extremity and core strengthening in the treatment of low back pain with radicular symptoms. Back pain, however, continues to be a prevalent problem in society.
REFERENCES


